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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

ANNUAL INVESTIGATIVE PROGRAM

1926

1925-1926

NORTHEASTERN FOREST EXPERIMENT STATION

AMHERST, MASSACHUSETTS

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NORTHEASTERN FOREST EXPERIMENT STATION

ANNUAL INVESTIGATIVE PROGRAM - 1926

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NORTHEASTERN FOREST EXPERIMENT STATION

Annual Investigative Program - 1926.

General Policy.

Scope and Character of Work.

No change has taken place or is proposed in the general scope and character of the Station's work as outlined in last year's investigative program. The Station's chief activities are still concentrated on a comparatively few major projects dealing primarily with the spruce and northern hardwoods region. The method of study has so far been chiefly by individual trees and temporary sample plots. The permanent sample plots which were established from 1905 on, and for which the Forest Service is responsible, were re-measured during the year, but no new permanent plots established. The importance of these is, however, fully recognized, and as soon as sub-stations are selected their establishment will be pushed as rapidly as possible without serious interference with current projects.

Perhaps the most striking development of general interest during the year has been the increasing realization of the large amount of time required for the working up of field data. It is becoming more and more clear that for most projects considerably more time, in many cases at least twice as much, is necessary to make full use of the data in the office than to collect it in the field. A short field season is, therefore, planned for the coming year in order to enable us to catch up with the data already obtained.

Another very important development is the assignment to the Station of representatives of the Office of Forest Pathology in the Bureau of Plant Industry and of the Division of Forest Insects in the Bureau of Entomology; namely, Dr. Perley Spaulding and Mr. H. J. MacAloney. The assignment of these men to the Station greatly broadens its field of work and makes possible the consideration of the pathological and entomological factors which enter into nearly every problem in forest management in a way that was previously out of the question.

It is hoped that this is merely a first step toward the bringing together of men qualified to specialize in other fields, such as physiology, soils, and meteorology. As our work gradually becomes more intensive, there will be an increasing need for men who are able to carry on the so-called "fundamental studies", and this of course implies specialization. At the same time, it is highly important that these specialists should have a forestry background and a forestry point of view. The ideal type of man is one who has secured a degree in forestry and later taken specialized work leading to a Ph.D. degree. Every encouragement should be given the schools to turn out more men of this type.

Mr. Tillotson's assignment to Amherst, with the same headquarters as the Experiment Station, is proving very helpful in keeping the Station more closely in touch with state foresters and other administrative agencies in the region. Mr. Tillotson is able to do much in informing us of the points of view and needs of the state foresters and extension foresters, and on the other hand is able to keep them more closely informed of our activities. The desirability of holding next winter a conference with the extension foresters of the seven northeastern states, in which it might be well also to include the state foresters, should be carefully considered.

The desire of the Station to cooperate fully with other agencies, and particularly with other branches of the Forest Service, has led to the development of closer relations than ever before with members of the District 7 and White Mountain National Forest staffs. Field trips were made by Mr. Dana with District Forester Kelley, Assistant District Forester Evans, and Supervisor Yarnall, during which various management problems were discussed and considerable attention given to possible sub-station sites. Ranger Graham and Forest Examiner Black have been helpful in handling the Station's permanent sample plots on the Cherry Mountain timber sale area, and a working plan has been prepared by the Station for a thinning experiment which the Forest desires to undertake on this area.

A tentative outline for the establishment of permanent sample plots was prepared and circulated last year among a number of forest schools, state foresters, and other foresters for criticism. This is now being revised with the idea of making it generally available for use by anyone interested, in the hope thereby of securing more uniform and consequently more comparable records. It is also planned as soon as the necessary time can be found to circulate working plans for the Station's major projects among those who might be interested.

Sub-Stations.

No definite locations for sub-stations have yet been decided upon. Progress in this direction has, however, been made on the White Mountain National Forest, where the situation has been discussed and a number of possible sites examined on the ground with District Forester Kelley and Supervisor Yarnall. The choice has now been narrowed down to three sites, among which it is hoped to make a final decision during the coming season. These three sites include tracts near Bartlett, the Gale River Ranger Station, and Woodstock, New Hampshire. It seems likely that it may be necessary to set aside more than one tract for experimental purposes in order to cover at all thoroughly the widely varying conditions on the Forest. If a final agreement regarding the location and administration of the experimental area or areas can be reached with the

District office during the coming season, it is planned next year to undertake the establishment on the Forest of a considerable number of permanent sample plots.

Consideration will also be given to the selection of sub-stations in other parts of the region, although it is somewhat doubtful whether any final decisions will be reached. The Battell Forest, owned by Middlebury College seems to be the most likely location in Vermont, and special attention will be given to the possibility of working out satisfactory arrangements for the establishment of a sub-station there.

The prospects for early action do not seem quite so good in Maine and New York. In Maine no offer of cooperation has been received, while in New York cooperation has been offered by the New York State College of Forestry and by Finch Pruyn and Company. There is, however, some question as to whether entirely satisfactory arrangements as to both location and administration can be worked out with either of these agencies.

The general policy in regard to sub-stations is to have them constantly in mind, but to go slow in their actual establishment until certain that really satisfactory tracts are available.

Current Projects - Progress and Plans.

Major Projects.

1. Methods of Cutting in Pure and Mixed Spruce and Balsam Fir Stands (Mc-1). This study was continued during the year in Maine, New Hampshire, Vermont, and New York. More time was spent in the field on this project than on any other, and a large amount of additional material procured. Altogether, 420 temporary sample plots have so far been established, of which 234 are in the spruce flat type, 156 in the spruce and hardwoods type, and 30 in the spruce slope type. While final results will not be available for quite a while, it is clear that one of the chief problems in the management of mixed stands has to do with the exact effect of the residual and second growth hardwoods. This is true from the standpoint both of the reproduction and establishment of the softwood species, and of the yield to be expected from them.

An abundance of reproduction is usually found on cut-over spruce land, with widely varying proportions of conifers and hardwoods. It is a striking fact that nearly all of the coniferous reproduction was established prior to cutting, while the bulk of the hardwood reproduction has usually come in subsequent to cutting. In the spruce flat type about 60 per cent of the seedlings are conifers (largely balsam fir) as against 40 per cent in the spruce and hardwoods type. In the latter type over extensive areas the hardwoods are getting the better of the conifers. This is due to their greater abundance and more vigorous early growth, to the greater supply of hardwood seed, and to expansion of the crowns of residual hardwoods. Accurate predictions of the average yield to be expected under the wide variety of conditions encountered on cut-over areas are very difficult, but illustrations can be given of the growth that has actually taken place on specific, representative areas.

The permanent sample plots established in 1924 on the White Mountain National Forest were examined twice during the season. The most interesting points brought out by these examinations are (a) the more vigorous reproduction of balsam fir as compared with spruce, in spite of the presence of ample seed trees of the latter; (b) the much greater reproduction of both spruce and balsam fir on bare soil than on duff and litter; (c) the much more abundant reproduction of hardwoods than of conifers on both types of seedbed; and (d) the relatively large amount of reproduction destroyed in logging operations.

In the three to four foot height classes, where preservation of the coniferous seedlings is particularly important because they have reached a height to compete successfully against the encroachment of hardwoods, the destruction of advance growth averaged nearly 25 per cent in the case of the spruce and balsam fir. In the case of the hardwoods, the destruction of seedlings in these height classes ran as high as 40 per cent. While this at first sight might seem to be advantageous, as offering more opportunity for the development of the softwoods, it is probably, in fact, the reverse, since sprouts are almost certain to follow the cutting, and because of their rapid growth to be an even more serious drawback to the growth of the softwoods than would have the original seedlings.

This project, with its many ramifications, is perhaps the most comprehensive on the Station's program. It will, therefore, be continued for at least a number of years, and perhaps indefinitely. Because of the large amount of unanalyzed data now on hand, however, only a comparatively small amount of field work will be done during the coming season. This will aim to secure sufficient additional information to fill in such holes as are brought to light by a thorough analysis of the available data. Its exact character and extent cannot be determined until further progress has been made on the office work.

It is important as soon as possible to extend the study to the spruce swamp and spruce slope types. In the types already studied much more information is needed as to the development of hardwood trees left on cut-over areas, with particular reference to their influence on coniferous reproduction. The practicability of increasing the proportion and the rate of growth of the coniferous seedlings by the weeding of second growth hardwoods of various species and sizes constitutes another important phase of the investigation. Further attention should also be given to the influence of seedbed conditions on reproduction and to the effect of logging on advance reproduction.

2. Growth and Yield of Spruce and Balsam Fir (ME-2). Sufficient figures have now been obtained in this project to make possible the preparation of normal yield tables for even-aged stands. Altogether, some 400 sample plots have been used, of which about 50 were measured by Mr. L. S. Murphy in his previous spruce yield study, 7 were permanent plots established in 1905, and the remainder were laid out in the course of the present study. It is believed that among these are represented nearly all of the fully stocked, even-aged, second growth spruce stands to be found in the Northeast. They are almost wholly from Maine, New Hampshire, and Vermont, stands of this character being very rare in New York.

The following figures indicate the yields to be expected from fully stocked, even-aged stands of red spruce:

Total age	Yield per acre in peeled cords		
Years	Site 1	Site 2	Site 3
55	50.6	37.9	24.2
65	65.2	50.5	33.2
75	73.6	58.0	39.6

The total age includes an allowance of 15 years for the seedlings to grow from the ground to breast height. Site 1 is taken as the site on which the average dominant and codominant tree reaches a height of 60 feet in 65 years;

site 2 a height of 50 feet in 65 years; and site 3 of 40 feet in 65 years. All trees 4 inches and over in diameter breast high are included, with allowance for a 1 foot stump and a 3 inch top. Cubic feet are converted to cords on the basis of 95 solid cubic feet per stacked cord of 128 cubic feet.

The high yields on site 1, in spite of the extremely slow seedling growth, are particularly worthy of note. The average yield of 1 cord of peeled wood per acre per year at 65 years of age indicates that under favorable conditions the possible yields from red spruce are not so low as has often been thought. The yields shown are not, of course, found over any considerable area under natural conditions, but neither do they indicate the results that might be obtained under intensive management with one or more thinnings.

The normal yield tables have been completed, and the report on them will be put in shape for publication during the coming spring. The great need now in connection with this project is further study of the application of normal yield tables to the empirical stands and hardwood mixtures commonly found in nature. A start in this direction was made during the past season, but the amount of material collected is not sufficient to enable a satisfactory answer to this difficult problem.

A long time study by means of permanent sample plots to determine the approach of understocked stands of different ages and densities and on different sites to normality is of great importance. Lack of knowledge on this point is one of the chief obstacles to the practical application of normal yield tables. Another phase of the study in need of attention is the obtaining of accurate converting factors for expressing the cubic foot yields of different sized trees and stands in terms of cords. A little information on this point is available through some of the pulp companies, but hardly enough to be really satisfactory.

It is unfortunate that Mr. Meyer's transfer to the Pacific Northwest Forest Experiment Station at this time makes it impossible to carry this project to its logical conclusion. Work on it should be resumed as soon as the resources of the Station permit.

3. Development of Universal Taper and Volume Tables (MB-1). The comprehensive study of form which is being conducted under this title has progressed rather slowly. A report on form class taper curves and volume tables and their application has been completed, submitted to a board of review, revised, and transmitted to the Washington Office for publication. The report brings out the great similarity in form of many commercial conifers in the United States and in Europe, and develops a mathematical formula to approximate the generalized taper curves. Particular attention is devoted to the evaluation of errors arising from

various sources, the analysis of which is made possible by the form class percentile taper method.

During the field season of 1924, measurements were obtained of 893 spruce and balsam fir trees from 29 localities (639 by climbing in even-aged second growth stands). The preliminary calculations on these were completed early in the spring of 1925 and the data transferred to punch cards to facilitate study of the many correlations involved. Although the punch card data did not get back from Washington in time to permit analysis of the results before the field season of 1925 was at its height, it was obvious that the 1924 data were too localized to represent adequately the range of age classes, sites, densities, and types found in the region.

Additional field data were secured during the early part of the 1925 season from cutting operations in New York, Vermont, and New Hampshire, where most of the stands studied were many-aged, old growth red spruce. At the end of the season work was moved to the maritime region of eastern Maine in order to get a representation from this section, and especially to get older age classes of even-aged red spruce and additional white spruce material. Climbing was again resorted to for this purpose.

Practically all of the preliminary calculations for the 1925 material have been completed, but these will not be transferred to punch cards until the 1924 figures have been studied more thoroughly in order to detect and correct any weaknesses in the method of coding and tabulating. Two instances in which the punch card data can be made more serviceable have already been discovered, and it is probable that before the final compilation is attempted all of the 1924 material may be repunched in order to overcome these weaknesses. This duplication could hardly be avoided in the light of our experience with the tabulating machine and with the requirements of multiple correlation studies.

There are now available measurements of 1,789 trees from 61 stands. For red spruce it is felt that the data cover sufficiently the range of density, age, site, and type to draw fairly reliable conclusions. The data for the other species are not so complete, and it may prove desirable to devote additional field work this year to rounding them out. It is also likely that it may prove worth while with red spruce as well as with the other species to secure data which will throw more light on Jonson's theory that the form of a tree is determined chiefly by wind pressure as compared with Hohenadl's theory that the form of a tree is developed so as best to enable it to support its own weight. It is still hoped that some cooperation may be possible with Mr. Newlin on this phase of the project.

Preliminary examination of the data indicates that about three-eighths of the variability of bark thickness and butt swell in even-aged red spruce may be directly a function of the diameter of the tree. Further study is needed to learn which, if any, of the other factors which can be evaluated must be taken into consideration in arriving at a more dependable reduction of breast height diameter for bark thickness and butt swell. The relation in old growth appears somewhat different, but still ties in very well with size.

A large amount of office ✓ will be required to make full use of the data now available and still to be collected. While it is hoped that fairly conclusive results can be secured within the next year, there are so many angles to the problem and so many factors to be considered that it is impossible to make any really reliable prediction on this point. Preliminary volume tables which are apparently very satisfactory have been prepared for immediate use in connection with the spruce yield study.

At several points in the study difficulty has been experienced as a result of the inconsistency in the technique arising from the conception of the absolute form quotient as based upon the portion of the stem above breast height alone. The whole technique of the form class system might be greatly improved and rationalized by basing form quotients on the entire stem as a unit, and some study will be given to this matter before going much farther with the application of the system.

4. Analysis of Forest Fire Statistics (Ff,D-2). This study has progressed slowly, but satisfactorily, considering the great amount of material involved. The Massachusetts fire records for 1921, 1922, and 1923, and in part for 1924, have been run through the tabulating machine, but their analysis has not yet been possible. Further work on the Massachusetts statistics will probably have to be postponed until work for those states which are contributing financially to its support is out of the way, or until Massachusetts is in a position to contribute to the work.

The State of Maine has furnished a complete summary, in excellent form for coding, covering all forest fires both inside and outside the Forestry District for which reasonably accurate records are available. Within the Forestry District, which includes some ten million acres in the northern half of the state, this record runs back to 1909. All of this material will be placed on punch cards ready for tabulating prior to the beginning of the next field season. A cooperative contribution of $600 has been received from the Forest Commissioner to cover the cost of the work.

In the case of New Hampshire the fire records for the past five years are being coded by the State Forester in his office at Concord, New Hampshire. They will then be sent here to be transferred to punch cards, at the expense of the State Forester. The punch card data will be tabulated and analyzed toward the end of the summer, with the idea of preparing a special article which can be included as a feature of the State Forester's biennial report for the past two years.

All of the available fire records for the state of Vermont have now been placed on punch cards and are ready for tabulation and analysis as soon as time is available. The work was made possible through a contribution of $450 from his Clarke-McNary allotment by the Forest Commissioner of the state.

Work is also well advanced on Connecticut fire records since 1920, at which time an analysis of the statistics covering the previous ten years was made and published by the State Forester. This material also will be analyzed and a report on it prepared toward the end of the summer. The work was made possible by a contribution of $300 from his Clarke-McNary allotment by the State Forester.

It is hoped to clean up the analysis of all back data for Maine, New Hampshire, Vermont, and Connecticut during the coming year, and an effort will be made to do the same with Massachusetts and New York just as soon as the necessary time and money are available. It is also hoped that after the back records have once been brought up to date it may be possible to keep current records up to date from then on. This will involve the coding, punching, and analysis of each year's fire statistics for the entire region as soon as they are available. A project of this sort is obviously a sizeable and time-consuming one, which will require each year a large amount not only of clerical assistance in coding, punching, and tabulating, but also of technical assistance for analysis of the results. It is believed, however, that the cumulative record which will result from such a project will be of sufficient importance to justify the cost. With adequate appropriations it would be possible for the Station to bear the entire expense of the work, but with our present allotment it is doubtful whether this can be done.

A development of considerable importance in connection with this project was a conference held at Boston on January 26, 1926, of northeastern state foresters and representatives of the Forest Service to consider uniformity of forest fire reports. After an all-day discussion substantial agreement was reached as to the essential items which should, if possible, be used in the report of every fire and as to the meaning of the various terms used on the report forms. Mr. Tillotson and Mr. Dana were asked to serve as a committee to formulate the consensus of opinion as expressed by the conference and to forward this to all of the state foresters for their criticism and comment. The preliminary statement was then to be revised in the light of these comments and a final report issued as embodying the recommendations of the conference. This has now been done, and the final statement will be issued shortly.

It is not anticipated that any two states will use exactly the same form or will attempt to secure exactly the same information. It is, however, believed that most of the states will be willing as soon as possible to revise their forms so as to include all of the information regarded by the conference as essential, in addition to which they will, of course, include such other details as they regard as necessary for administrative or other purposes. This result will represent a great advance in making the fire records for the region more complete and more uniform, and consequently more valuable from every point of view.

5. Prediction of Fire Conditions (Pf, C-7). Field work was undertaken for the first time during the year on the relation of weather conditions to fire hazard. Through a contribution of $250 from the Empire State Forest Products Association, and through the courtesy of the New York State College of Forestry in allowing the use of the Pack Demonstration Forest at Cranberry Lake in the western Adirondacks, a complete series of records was secured on this tract from the latter part of July until early October.

The work was concentrated at two stations about a hundred yards apart on nearly level land at an altitude of approximately 1800 feet. One of these was in an area which had been clear cut for softwoods in 1921 and is now covered with blueberries and other low shrubs; while the other was in an area which had been culled for softwoods at the same time and is now covered with a fairly dense stand of mature northern hardwoods. At each station daily observations were taken at three-hour intervals from 7:00 A. M. to 7:00 P. M. of air and soil temperature, air pressure, relative humidity, vapor pressure, rainfall, wind movement and direction, evaporation, and duff moisture. The duff consisted of partially decomposed hardwood leaves varying from about two to three inches in depth, and its moisture content was determined with the duff hygrometer.

In order to translate weather conditions into terms of fire danger, it is, of course, necessary to determine not only the effect of different combinations of weather conditions on the moisture content of various fuels in different forest types but also inflammability of these fuels at different moisture contents. Little work has so far been possible on this latter phase of the problem, which will be emphasized during the coming year. Meanwhile, in making preliminary analyses of the data already secured, it seems fairly safe to assume, on the basis of western experience and of the few tests so far made here, that there is virtually no fire danger with a moisture content of more than 20 per cent and comparatively little with more than 15 per cent.

Such preliminary analyses indicate that for the forest type, region, and rather abnormally wet character of season concerned, the following tentative conclusions may be drawn:

a. Rainfall and relative humidity are the most important meteorological factors influencing the moisture content, and therefore the inflammability, of the duff.

b. The influence of rainfall on the surface duff ordinarily lasts about thirty-six hours in the open and from 24 to 48 hours longer under a hardwood cover. Exceptions to this rule are due to unusually high wind velocity or temperature.

c. After the influence of the rainfall has disappeared, changes in the moisture content of the surface duff follow very closely changes in the relative humidity of the air. Both invariably rise during the night. In 1925 there was not a single night in which the moisture content of the duff did not exceed 20 per cent, a point presumably beyond that of fire danger.

d. The moisture content of the surface duff frequently fell below 15 per cent, both in the open and under the hardwoods, with an air humidity as high as 40 to 60 per cent. Changes in duff humidity appear to follow changes in air humidity with very little lag.

e. The moisture content of the duff at a depth of one inch never fell below 15 per cent in the open or 25 per cent under the hardwoods. This deeper duff undoubtedly acted as a reservoir which furnished a continuous supply of moisture to the surface layer.

It is hoped during the coming season to be able to continue observations at the two stations at Cranberry Lake, and also to establish similar stations on adjacent cut and uncut areas in the spruce slope type in the eastern Adirondacks and in the white pine type in northern Massachusetts, probably at Petersham. Whether this expansion of the project will prove feasible, however, depends entirely on the cooperation available. It seems probable that the New York State College of Forestry may be able to take over the Cranberry Lake stations and that the Empire State Forest Products Association will be willing to continue its financial assistance. In this case it is fairly certain that a new station can be established in the upper spruce type in the eastern Adirondacks, probably near Boreas Pond. The establishment of similar stations in the white pine type at Petersham is equally desirable, and will probably be made possible through cooperation by the Harvard Forest.

The 1925 records for the two stations at Cranberry Lake have been placed on punch cards and run once through the tabulating machine. Their detailed analysis will be undertaken later in the season and will undoubtedly suggest ways and means of making the most use of the data to be secured during the coming year. The material already available is, of course, not sufficient in amount to warrant drawing anything but decidedly tentative conclusions from it. Observations should probably be continued for at least three years in the same locality in order to determine the effect of seasons with rather widely varying meteorological conditions. Work in all of the important forest types of the region is also essential. Eventually, it is hoped that it may be possible to rate any given area both as to its general fire hazard from the standpoint of climate and as to its specific fire hazard under current weather conditions.

In connection with the latter, detailed forecasts by the Weather Bureau of fire weather conditions for as long a period in advance as possible are essential. This phase of the work, as well as the Forest Service phase of determining what any given combination of weather conditions means in terms of fire hazard, should be pushed. During the past year the representatives of the Weather Bureau at Boston, New Haven, and Albany were ready on request to supply special forecasts to the various state foresters concerned. The season was, however, such a wet one that there was little or no occasion to take advantage of this offer. A number of meteorological stations were also established in Maine and New York to supply additional data for the Weather Bureau officials. The work will be continued this year along the same lines as last. It will not, however, attain its highest usefulness until more detailed studies make possible the prediction of the specific factors contributing most largely to the creation of fire hazards.

6. Slash Disposal (Mb-1). With the assignment of a forest pathologist to the Experiment Station, a comprehensive study of slash disposal has become one of its major projects. This study was decided upon after an all-day conference between representatives of the Forest Service, Bureau of Plant Industry, Bureau of Entomology, Harvard Forest, and New York Conservation Commission. Information is greatly needed from the standpoint both of fire control and of silviculture as to the rate of decay of slash of different species, in different forest types, and under different topographic, soil, and climatic conditions. Such information is obviously basic in deciding upon the method of slash disposal which should be used, under any given set of conditions, but wide differences of opinion now exist as to the actual facts in the case.

After a field survey, followed by a second conference of representative foresters, pathologists, and entomologists, it was decided to concentrate the work during the first year on the white pine type and on the mixed spruce-northern hardwoods type. It was also decided that the study should be conducted both by the establishment of permanent sample plots and by surveys of cut-over areas in order to secure information more promptly, even if less accurately, than is possible by the permanent sample plot method.

Most progress was made during the season in studying the decay of white pine under different conditions in southern New England. The preliminary results indicate that white pine slash does not ordinarily disappear completely for at least twenty years. On the other hand, some decay usually sets in as early as the second or third year, and is fairly well advanced by the sixth to eighth year. Just how this early decay affects the fire danger cannot be stated definitely until much more is known as to the inflammability of material in different stages of decay. This is one of the most important and at the same time most difficult phases of the study. An interesting development in connection with the rate of decay is the apparently strong indication that such decay is considerably retarded on north and west as compared to south and east slopes. Presumably this is due to a retarding of fungous activity as a result of lower temperatures on the north and west slopes.

A concurrent and cooperative study of the influence of white pine slash on reproduction has been made by Mr. Altpeter, a graduate student at the Harvard Forest. The results of this phase of the study are not yet available in detail, but a preliminary analysis of the data indicates clearly the influence of windrowed slash in preventing reproduction in the area covered by the windrows.

Some cooperative work has also been done by the Bureau of Entomology on the influence of insects in promoting the disintegration of slash. In several localities white pine slash was covered by cages of different meshes, as well as left uncovered, to determine just what insects were the chief ones to attack the slash. This material will be inspected from time to time. The same procedure was followed with pitch pine on the Myles Standish Forest near South Carver, Massachusetts. During the first year, the influence of the larger wood borers in attacking and helping to break up the slash has been very noticeable.

In addition to the work with white pine, permanent sample plots were laid on the Cherry Mountain timber sale on the White Mountain National Forest, where the proper disposal of hardwood slash is a much mooted question, to determine the rate of decay of hard maple, yellow birch, beech, spruce, and balsam fir slash disposed of by different methods. On one of the plots all of the slash was lopped so as to bring it into contact with the ground; while on the other the loggers were allowed to leave it as they desired, on the assumption that this would probably result in some of it being piled, some windrowed, and some left as more or less isolated tops. The cutting of the plots, which were laid out in the fall, was to be done during the present winter. The adjacent timber sale areas where all of the softwood slash is burned will serve for the study of this method of disposal in comparison with the methods used on the sample plots.

The work will be continued during the coming year along the lines already started. More attention will, however, be paid to a survey of cut-over areas of different ages in the spruce and northern hardwoods type. It is hoped that by the end of the year this may have gone far enough to enable the drawing of tentative conclusions as to the efficacy of lopping in promoting the decay of hardwood tops. Survey work with the white pine will also be continued, and it is hoped that a number of permanent sample plots may be established in both types.

Special attention will also be paid to the relation of slash disposal to reproduction in the spruce and northern hardwoods type. This phase of the work will be handled by Mr. Westveld, in close cooperation with Dr. Spaulding, and will tie in very closely with the former's study of methods of cutting.

7. Control of White Pine Weevil (Pi-4). This also has become a major project with the assignment to the Station by the Bureau of Entomology of a forest entomologist. The study was made possible largely by an anonymous contribution to the Bureau of Entomology of

$2,500 a year for the next two years. The work has been concentrated at, although by no means limited to, Petersham, where it is being conducted in cooperation with the Harvard Forest.

Three main lines of attack have been followed: first, the obtaining of additional information regarding life history, with particular reference to hibernation and flight; second, the important parasites and predators attacking the weevil, with special reference to the possibility of artificially increasing their numbers; and third, the effect of ecological conditions, particularly density and mixture, on weevil damage and control. The work was somewhat handicapped because of the impossibility of undertaking it earlier in the season. Much information of value was, however, obtained. Some 2,500 infested leaders were collected for the breeding of parasites, and over one hundred permanent and semi-permanent sample plots were established. The importance of hardwoods in lessening weevil damage, and of dense stands in enabling weeviled trees to recover, was emphasized by the season's work.

Active cooperation in the project was received from the Connecticut Agricultural Experiment Station, which arranged for an assistant to devote some three weeks to the collection of sample plot data that has been made available for the use of the Experiment Station. There is a possibility that cooperation may also be received during the coming season from the state of Vermont. The New York Conservation Commission is conducting an independent study of the problem, the results of which will naturally be of much interest in connection with our own work.

Plans for next year contemplate continuing the study along the lines already started. While much of the work will still be concentrated in northern and central Massachusetts, it is hoped to cover a somewhat wider territory than last year in order to secure more exact data as to comparative conditions in different parts of the region.

8. Relation of Light and Soil Moisture to Tree Growth (T-1). With the proposed change in Mr. Gast's status, discussed under "Finances", by which he will become virtually a regular member of the staff, this study should be classed as one of the Station's major projects. The work already done has resulted in the development of satisfactory electrical equipment for the measuring and recording of total light intensity. Progress has also been made in the determination by chemical means of the amount of ultra-violet light received. Continuous records were secured last summer of the light intensities at three adjacent stations in the white pine type, - one in a clear cut area, the second in an area from which part of the stand has been removed by a shelterwood cutting, and the third in an uncut stand. These are now being worked up for publication, together with some more general material on the

relation of light to tree growth.

Some progress has been made in developing a method for the measurement of soil moisture by the use of sulphuric acid. More promising still are plans for the improvement of the "soil point" method for measuring available soil moisture devised by Dr. Livingston some years ago. Soil acidity and the action of soil bacteria have received some attention.

During the coming year it is planned to concentrate the work on studies of the relation of light and soil moisture to tree reproduction and growth. In addition to perfecting the instrumental equipment necessary for the accurate measurement of both factors, special attention will be paid to determining the critical amounts necessary for the survival of seedlings and for their normal growth. The field indications will later be followed up by laboratory experiments under controlled conditions. Work on this project will be tied in with that on the fire weather project, particularly with reference to duff moisture content and soil moisture content as influenced by weather conditions.

The work will continue to be conducted in close cooperation with Harvard University, and particularly the Harvard Forest. Field work will be centered at Petersham, although it is hoped that some measurements may be possible on the permanent sample plots established in 1924 on the White Mountain National Forest. Office work will be centered at Amherst, with as frequent trips to Cambridge as may be necessary to keep in touch with the cooperators there.

Minor Projects.

No particular discussion of the Station's minor projects is necessary aside from that included in the status sheets. Work on all of these projects except the pruning of white pine started in 1924 and has continued in accordance with the original plans. Most of them are conducted at Mount Toby, about ten miles from Amherst, where the field work connected with them can be handled early in the spring before the field season opens in the northern part of the region.

The second part of the minor project dealing with the replacement of chestnut (M-3) was completed during the year. A final report on the survey to determine just what changes have been taking place on blight-killed areas was completed jointly by Mr. Korstian and Mr. Stickel, and has been submitted to the Washington office for publication.

The survey by the Bureau of Entomology to determine the present status of the pine shoot moth (Pi-5) has also been completed. This indicated that the moth is now widely spread throughout the region but does not appear to be doing any serious damage to forest trees. Its distribution is apparently so wide as to make its extermination extremely difficult if not impossible. In view of the slight damage now being caused by it under forest conditions, no particular control measures seem necessary. The Bureau of Entomology, however, plans to keep close watch of further developments, so that prompt attention may be called to the need for action should the activities of the insect assume a more alarming aspect.

One new minor project on the pruning of white pine was added to the Station program last year. No work was done on this, however, because approval of the project was not received until the field season was at its height and practically all of our attention absorbed by the major projects. It is planned to start the project this spring by the establishment at Mount Toby of three quarter-acre sample plots, one of which will be pruned this spring, a second several years later, and the third left intact as a check plot.

With the taking over of Mr. Peirson's studies (Pi-2 and Pi-3) by the state of Maine, these became minor projects from the standpoint of the Station. It is, in fact, believed that they might well be dropped as an integral part of the Station's program for the coming year. This does not mean that our interest in them is any less than before, but merely that some other agency is primarily responsible.for them. For the same reason the project on control of the gipsy moth by forest management, which is handled by the Office of Moth Control in the Bureau of

Entomology, is being dropped from the program this year.

All-Service Projects.

There are now four all-Service projects on the Station's program. Aside from the preparation of the manual on forest measurements, no striking progress can be recorded on any of these. Mr. Behre has, however, been active as a member of the joint committee responsible for the preparation of the mensuration manual, which has tied in rather closely with his project on the development of form class percentile taper tables. Information is gradually being secured on the other projects as opportunity offers.

Some confusion has been caused by the assignment to all-Service projects of the same numbers already in use for Station projects. For example, "Regional Yields" and "Development of Universal Taper and Volume Tables" are both designated ME-1; while "Converting Factors" and "Growth and Yield of Spruce and Balsam Fir" are both designated ME-2. The best way to handle this situation appears to be to add the initials "WO" to the designations of the all-Service projects. It is, however, suggested that a preferable plan would be to give present and future all-Service projects a higher series of numbers, say beginning with 100, so as to avoid any possible conflict with the numbers of regional Station projects.

New Projects.

The only new project proposed for the coming year is a study of borers affecting yellow birch and paper birch, with special reference to the bronze birch borer. Considerable damage is now being done to these species in the northern hardwoods region, particularly on cut-over areas. This damage is of special importance wherever, as is the case in the White Mountain National Forest, young yellow birches are reserved on cutting areas with the expectation of their future development. It is decidedly questionable, in view of the liability of such trees to insect injuries, whether the anticipated results will actually be realized.

The primary object of the work during the coming summer will be to get definite information as to the present severity and extent of injury and as to the best locations for further, more intensive study. The investigation will be handled by Mr. MacAloney as a minor project and will not be allowed to interfere with his major work on the white pine weevil.

No other new projects are proposed, not because there are none of importance which might be undertaken, but because the Station program is already crowded in spite of our efforts not to take on more than we can handle effectively. It is believed that the starting of new projects, except in cases of great urgency, should be postponed until further progress has been made and more definite results secured on some of our major projects.

Cooperation.

Regional Program.

The statement of forest investigations under way in New England and New York, compiled by the Experiment Station shortly after its establishment and issued in mimeographed form during 1924, was brought up to date as of April 1, 1925, by the issuance and distribution of a supplementary mimeographed statement. This supplement showed a list of 75 projects not included in the original statement. A few of these had been undertaken since the publication of the latter, but most of them had been under way for some time, although not previously reported to the Station. The supplement also showed that 25 projects included in the original list had been completed.

The revised statement showed that forest investigations under way in the Northeast on April 1, 1925, comprised 264 projects, distributed by lines of work as follows:

	Number
Dendrology	7
Forestation	38
Forest Ecology	24
Forest Economics	8
Forest Fish and Game	13
Forest Management	65
Forest Mensuration	34
Forest Protection	49
Forest Recreation	1
Forest Products and Utilization	25
Total	264

It is believed that this latest list is sufficiently complete so that another supplement will hardly be necessary this year. It is, however, quite possible that by another year a complete revision of the original statement should be issued so as to bring together in one place for ready reference as complete information as can be obtained regarding the status of forest research in the region. Such information is not only a matter of general interest, but is believed to be a real help in bringing about a better balanced program and better coordination of effort between research workers.

Northeastern Forest Research Council.

Two meetings of the Northeastern Forest Research Council have been held since the submission of the last investigative program. A particularly interesting field meeting was held from June 22-24, 1925, with the Brown Company at its mills at Berlin, New Hampshire, and at one of its woods headquarters at Cupsuptic, Maine. Forest fire studies were discussed at considerable length with special reference to the relation of weather conditions to fire hazard, and much time was devoted to a field inspection of some of the experiments initiated by the Brown Company. A number of cut-over areas typical of the spruce-northern hardwoods region were examined, and some lively discussions held as to the best methods of management.

The most recent meeting of the Council was at Springfield, Massachusetts, on December 10, 1925, immediately preceding the Second New England Forestry Congress. This meeting was devoted largely to consideration of the progress so far made by the Experiment Station on its major projects and of its plans for future work. Many of the technical points involved were gone into in considerable detail, and gratification was expressed at the progress which the Station has been able to make in the two years of its existence with the limited resources available. The importance of soil studies in connection with the Station's investigations of reproduction and growth was strongly emphasized, and the Secretary of Agriculture was urged to make available assistance in this field.

An interesting feature of this meeting was the appearance before the Council of two members of the New York State Conservation Commission, Mr. McIntyre and Dr. York. These men appeared at the request of Mr. Pettis to inform the Council as to the present status and needs of the gipsy moth barrier zone project to prevent the spread of the moth west of the Hudson River, and of white pine blister rust control activities in the Northeast. Mr. Burgess, who is in charge of moth control for the Bureau of Entomology, also discussed the barrier zone project and other phases of the gipsy and browntail moth work. On the strength of the facts presented, the Council voted to urge full participation by the Federal government in the continuation of both projects on their present scale.

The terms of the three members of the Council whose original appointments were for two years expired in February, 1926. These were P. S. Collier, Franklin Moon, and F. A. Waugh. Secretary Jardine has asked George T. Carlisle, Jr., consulting forester, Bangor, Maine; E. M. Lewis, acting president, Massachusetts Agricultural College, Amherst, Massachusetts; Franklin Moon, dean, New York State College of Forestry, Syracuse, New York; and Mortimer R. Proctor of Proctor, Vermont, to serve in their place for the next four years.

Advisory Committee from Pulp and Paper Industry.

No meetings of this committee were held during the year. Plans for such a meeting were tentatively discussed with its chairman, Mr. Ostrander, and with Dr. Baker, secretary of the American Paper and Pulp Association, in the late fall, but no definite arrangements were made. Subsequently the proposed reorganization of the country-wide Advisory Committee of the Pulp and Paper Industry to the Department of Agriculture made it seem desirable to postpone further plans for any meeting of the Sub-committee for the Northeastern States until the reorganization should be actually effected.

Massachusetts Agricultural College.

Cooperation with the Massachusetts Agricultural College has continued to be both close and harmonious. The advantage of having the Station located at an institution of this sort where intimate contacts can be maintained with specialists in the field of agricultural research is becoming more and more apparent as the work develops and as such contacts become more firmly established.

Office quarters in French Hall have been doubled during the year through the courtesy of the College in making available the large laboratory room immediately above our original quarters. In spite of the fact that this has not been subdivided into separate offices, it is no more noisy than the downstairs rooms, the only difficulty with the present arrangement being a somewhat greater tendency toward confusion when there are many in the room than would be the case if it were subdivided.

A room has also been made available for Dr. Spaulding's use on the third story of Clark Hall, which serves as headquarters for the botanical and pathological staff of the College. While it is regretted that it was impossible to house Dr. Spaulding in the same building with the rest of the staff, this was impracticable both for lack of room and because French Hall is without gas, which is essential for some of his laboratory work. During the winter our present quarters are filled to capacity, and additional space will be necessary as soon as any enlargement of the staff becomes possible. It is not clear at this time where such space can be found.

In accordance with the cooperative agreement between the Service and the College, the Station is obligated to render each year such assistance in the matter of instruction as is desired by the College and as is possible without seriously interfering with our own activities. During the present winter a course in forest ecology has been given under the title of "Landscape Gardening 195" to a class consisting of three graduate and nine undergraduate students. Instead of dividing the twenty lectures involved (two a week for ten weeks) among the entire staff, as was done a year ago, the work this year was handled entirely by Mr. Westveld and Mr. Stickel. The new plan was adapted because of the belief that it would interfere less with the work of the Station as a whole and would prove more satisfactory from the standpoint of the students. Its success is indicated by the following statement by Professor Waugh: "We believe this is the best course of its kind we have yet had given, and we wish you to understand how greatly we appreciate the help given us by the Northeastern Forest Experiment Station staff, and especially the excellent and faithful work put into this course by Mr. Stickel and Mr. Westveld."

Other Outside Agencies.

Reference has already been made in connection with the discussion of specific projects to cooperation with various other agencies. For the same of convenience it may, however, be well to summarize such cooperation briefly at this point.

Financial cooperation in the conduct of the Station's forest fire projects has been received as follows:

State of Maine	$600
State of Vermont	450
State of Connecticut	300
Empire State Forest Products Association	250

Cooperation has also been received from the state of New Hampshire in coding its fire records for the past five years, from the state of Maine in preparing a compact of all its fire records, and from the New York State College of Forestry in making the Pack Demonstration Forest at Cranberry Lake available for the fire weather study and in furnishing certain equipment therefor. Equipment for this study has also been loaned by the Harvard Forest and the Yale School of Forestry. Clark University has cooperated in the study of certain phases of the relation of weather conditions to fire hazard.

Cooperation has been maintained with the state of Maine in the studies of the spruce budworm and other forest insects being handled by Mr. Peirson, who has, as in previous years, spent some time at the Station. The cooperation by the Connecticut Agricultural Experiment Station on the white pine weevil project has already been mentioned, as has also the anonymous gift of $2,500 a year for two years, without which the weevil project could not have been undertaken on anything like its present scale.

The Station cooperated with the Massachusetts Forestry Association in the observance of American Forest Week and in the Second New England Forestry Congress. At the latter an exhibition of the instruments used in forest research was arranged by the Station, and attracted much interest and favorable comment. Numerous talks have been given during the year to various scientific and other organizations.

Other Bureaus in Department.

In order to make the discussion of cooperation complete, reference should be made here as well as previously to the permanent assignment of a forest pathologist and a forest entomologist to the Station by the Bureaus of Plant Industry and Entomology. The virtual addition of these men to the Station staff is of the greatest help in making it possible to give more consideration to these important phases of forest management. It is hoped that additional representation from both bureaus will shortly be possible, since the pathological and entomological forest problems of the region are sufficiently urgent to justify much more attention than can now be given them.

Mention should also be made of the cooperation of the Weather Bureau through its local officials at Boston, New Haven, and Albany in making fire weather forecasts for the various state foresters. These officials have also been interested in the investigative aspects of the Station's fire weather studies, and it is hoped to develop further and closer contacts with them as the work progresses. The assignment to the region of a reppresentative of the Weather Bureau who could devote his entire time to the meteorological aspects of the fire weather problem is urgently needed, and would contribute greatly to the effectiveness of our present studies.

Finances.

Silvical Investigations.

The estimated expenses of the Experiment Station for the fiscal year 1927 on the basis of our present allotment of $27,495 are as follows:

	Salary	Expenses
S. T. Dana, Director	$5,400	$600
C. E. Behre, Associate Silviculturist	3,400	400
M. Westveld, Associate Silviculturist	3,100	400
P. W. Stickel, Junior Forester	1,920	600
Vacancy, Junior Forester	1,860	400
P. R. Gast, Agent	1,000	200
M. E. Turrell, Senior Clerk	1,920	
R. M. Delaney, Ass't Clerk	1,560	
K. E. O'Neil, Ass't Clerk, 6 mos. at $125	750	
M. A. Westveld, Field Assistant, 4 mos. at $90	360	400
Vacancy, Field Assistant - 10 mos. at $80	800	400
W. B. Barrows, Computing Clerk, 6 mos. at $125	750	
Auto operation and maintenance		550
Telephone and telegraph		100
Freight and express		50
Equipment and supplies and miscellaneous		575
Total	$22,820 4675	$4,675

This line-up does not provide for filling the vacancy caused by Mr. Meyer's transfer to the Pacific Northwest Forest Experiment Station by another assistant silviculturist. Instead, it contemplates the addition to the staff of a new junior forester and the doubling of our present contribution toward Mr. Gast's support. The junior forester would serve during the first year at least as an apprentice, assisting the other members of the staff in the conduct of their projects, and would not be given an independent project of his own. It is hoped, however, that we may secure someone who will develop into a desirable permanent addition to the staff, and with this possibility in view the employment of a full-time junior forester is recommended in place of an equivalent amount of temporary field and office assistance.

The proposed increase in our contribution toward the support of Mr. Gast is recommended with the expectation of taking him over on a full-time basis as soon as the necessary funds are available. His development during the past year has been satisfactory, and it is believed that he is the best man available whom we could secure for the so-called "fundamental" investigations. He has the forestry point of view and is greatly interested in proving the value of fundamental work in the solution of practical forest problems. During the coming year the Harvard Forest is willing to contribute the same amount as the Experiment Station toward his support. This means that the work will continue to be handled on a cooperative basis, but with somewhat more control over Mr. Gast's activities on the part of the Station than has previously been possible.

The assistant clerk for six months at $125 a month represents our share of a full-time stenographer, the other half of whose salary will be met from Mr. Tillotson's allotment under Clarke-McNary funds. Her services will be used primarily, as far as the Experiment Station is concerned, by Dr. Spaulding and Mr. MacAloney, although any spare time which she may have can be used to excellent advantage by other members of the staff.

It is believed that no explanation of the other items in the proposed budget is necessary. Should any promotions be made during the year, they will have to be financed by reducing the amounts for travel or for temporary assistance. Attention should, perhaps, be called to the fact that the estimates for travel are low because of the plan to limit field work to a minimum in order to make it possible to catch up with the data already obtained.

Attention must again be called to the fact that additional funds are necessary to continue the work of the Station effectively on its present basis, to say nothing of any expansion. Travel, temporary assistance, both in the field and in the office, and equipment and supplies are already cut to the bone. Next year the present automobile will have to be replaced, and an additional car could be used to excellent advantage. It should also be borne in mind that the Station now has only four men in charge of projects and is limiting its major activities almost wholly to the northern part of the region. It is highly important to have a larger force capable of assuming charge of investigations, and to start work in the near future in the Allegheny hardwoods, sprout hardwoods, and white pine regions, to say nothing of the importance of expanding the present work in the spruce-northern hardwoods region. It is also highly desirable to add as soon as possible specialists for the conduct of more fundamental studies in physiology, forest ecology, and soils. In short, the need for additional funds is really urgent.

Cooperative Funds.

The present balance in the cooperative fund for spruce budworm investigations is $2,520.37. This is being held, in accordance with an understanding with the contributors, for the payment of certain of Mr. Peirson's expenses and for any emergencies which cannot be met by the State of Maine. There is also the possibility that the state may not be able to continue its present complete financial support of the work, in which case the use of the cooperative fund now at the Station would be necessary. As soon as there is any certainty on this point, arrangements will be made either to transfer the present balance to the state or to make such other disposition of it as the original contributors may prefer.

No cooperative funds for forest fire studies for the next fiscal year have yet been received. It seems probable, however, that the Empire State Forest Products Association will continue its assistance, and that a contribution of $1,000 will be received through the efforts of Director Fisher of the Harvard Forest.

The contribution of $2,500 a year for the white pine weevil work is being handled by the Bureau of Entomology.

Publications

Last Year 25

"Form Class Taper Curves and Volume Tables and Their Application", by C. E. Behre. Submitted for publication in Journal of Agricultural Research.

"Comparison of Diameter Tape and Caliper Measurements in Second Growth Spruce", by C. E. Behre. Published in Journal of Forestry for February, 1926.

"Chart for Conversion of Percentile Taper Series", by C. Edward Behre. Published in Journal of Forestry for March, 1926.

"Forest Research in the United States", by S. T. Dana. Submitted for publication in Proceedings of World's Forestry Congress.

"Relation of Weather to Fire Hazard", by S. T. Dana. Progress report distributed in mimeographed form by Empire State Forest Products Association, and also published in Lumber World Review and possibly other lumber trade journals. ?

"The Mission of Forest Research", by S. T. Dana. Presented at Second New England Forestry Congress and submitted to Journal of Forestry.

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"Our Society's Aims", by S. T. Dana. Published in Journal of Forestry for January, 1926. 8p

"Weather Injury to Scotch Pine", by H. C. Belyea and H. J. MacAloney. Submitted for publication in Journal of Forestry.

"Methods of Reading Multiple Quantities from Curves", by W. H. Meyer. Submitted for publication in Journal of Forestry.

"Longevity of Blister Rust Teliospores and Sporidia", by P. Spaulding. Published in Rept. Proc. Tenth Ann. Blister Rust Conference, Washington, D. C., Feb. 18-25, 1925. (Mimeographed.)

"Notes on Other Matters Pertaining to the Office of Forest Pathology", by P. Spaulding. Published in Rept. Proc. Tenth Ann. Blister Rust Conference, Washington, D. C., Feb. 18-25, 1925. (Mimeographed.)

"The White Pine Blister Rust in Vermont", by P. Spaulding. Published in Blister Rust News, May 15, 1925. (Mimeographed.)

"Report of Editor-in-Chief of Phytopathology", by P. Spaulding. Published in Phytopathology for May, 1925.

"Conditions Antecedent to the Infection of White Pines by Cronartium ribicola in the Northeastern United States", by P. Spaulding and Annie Rathbun-Gravatt. Published in Phytopathology for October, 1925.

"Longevity of the Teliospores and Accompanying Uredospores of Cronartium ribicola Fischer", by P. Spaulding and Annie Rathbun-Gravatt. Published in Journal of Agricultural Research for November 15, 1925.

"A Partial Explanation of the Relative Susceptibility of the More Important American White Pines to the Blister Rust", by P. Spaulding. Published in Phytopathology for October, 1925. 6p

"Natural Replacement of Blight-Killed Chestnut in the Forests of the Northeast", by C. F. Korstian and P. W. Stickel. Submitted for publication in Journal of Agricultural Research.

"Notes on Damage to Spruce and Fir Reproduction thru Logging", by M. Westveld. Submitted for publication in Journal of Forestry.

Next Year 26

"Application of Form Class Volume Table System to Red Spruce, White Spruce, and Balsam Fir", by C. E. Behre. Estimated length 30 printed pages plus 10 tables and 10 figures. Suggested for publication in Journal of Agricultural Research. Ready for submission in spring of 1927.

"Timber Growing and Logging Practice in the Northeast", by S. T. Dana. Estimated length 30 printed pages. Suggested for publication as Department bulletin. Ready for submission in spring of 1926.

"Forest Experiment Stations - Their Development and Future", by S. T. Dana. Estimated length 20 printed pages. Suggested for publication in Journal of Forestry. Ready for submission in winter of 1926-27.

"Forest Fires in Vermont", by S. T. Dana and P. W. Stickel. Estimated length 8 printed pages plus 4 tables and 4 figures. Suggested for publication in biennial report of Vermont Forest Commissioner. Ready for submission in fall of 1926.

"Forest Fires in New Hampshire", by S. T. Dana and P. W. Stickel. Estimated length 12 printed pages plus 6 tables and 6 figures. Suggested for publication in biennial report of New Hampshire State Forester. Ready for submission in fall of 1926, provided the necessary coding of fire reports is done by the New Hampshire State Forester.

"Forest Fires in Connecticut", by S. T. Dana and P. W. Stickel. Estimated length 12 printed pages plus 6 tables and 6 figures. Suggested for publication in biennial report of Connecticut State Forester. Ready for submission in fall of 1926.

"Forest Fires in Maine", by S. T. Dana and P. W. Stickel. Estimated length 15 printed pages plus 6 tables and 6 figures. Suggested for publication as a bulletin of the Maine Forest Service. Ready for submission in winter of 1926-27.

"Growth and Yield of Even-aged Stands of Spruce and Balsam Fir in the Northeast", by W. H. Meyer. Estimated length 30 printed pages plus 25 tables and 10 figures. Suggested for publication as Department bulletin. Ready for submission in late spring of 1926.

"Influence of Physical Factors on the Viability of the Sporidia of Cronartium ribicola Fischer", by P. Spaulding and Annie Rathbun-Gravatt. To be published in Journal of Agricultural Research.

"A Sketch of the History of the Forest Tree Nursery Trade between Europe and America as Exemplified by the Eastern White Pine", by P. Spaulding. To be published in Proceedings of Agricultural History Society.

"Notes upon the White Pine Blister Rust in Europe", by P. Spaulding. To be published as Department bulletin.

"Podsol Formation in Forest Soils", by P. W. Stickel. Estimated length 10 printed pages plus 2 tables. Suggested for publication in Journal of Forestry or Ecology. Ready for submission in fall of 1926.

"Reproduction on Cut-over Pulpwood Lands", by M. Westveld. Estimated length 15 printed pages plus 6 tables and 5 figures. Suggested for publication as Department circular. Ready for submission in summer of 1926.

"Growth on Cut-over Pulpwood Lands", by M. Westveld. Suggested for publication in Journal of Agricultural Research. Estimated length 20 printed pages plus 8 tables and 5 figures. Ready for submission in late fall of 1926.

PROJECT STATUS SHEETS

Current Projects

Projects Dropped

Projects Completed

New Projects

Current Projects

Major Projects

MANAGEMENT

Project. Slash disposal (Mb-1).

Scope. To determine (a) the relation of slash of various species to protection of the forest from fire, disease, and insects; and (b) the desirability of various methods of slash disposal.

Status. A preliminary study of the decay of white pine slash in southern New England has been made and a report thereon prepared. This has been paralleled by a study by the Harvard Forest of the influence of white pine slash on reproduction. In several localities white pine and pitch pine have been cut and the tops covered by different meshed cages, which will be inspected from time to time, to determine the effect of different insects or absence of insects on the disintegration of slash.

Permanent sample plots have been established on the White Mountain National Forest to determine the rate and character of decay in lopped and unlopped slash of maple, yellow birch, beech, spruce, and balsam fir.

Plans. Work will be continued along the lines already started. Particular attention will be paid to a survey of cut-over areas in the spruce and hardwoods type to determine as definitely as possible the course of slash decay under different conditions, with special reference to the efficacy of lopping in promoting the decay of hardwood tops. This survey will be accompanied by a study (closely related to Mc-1) of the influence of slash on reproduction. The caging experiments begun in 1925 will be continued and other species besides white pine and pitch pine considered.

Assignment. Perley Spaulding, M. Westveld, and H. J. MacAloney, Northeastern Forest Experiment Station, in cooperation with Bureau of Plant Industry, Bureau of Entomology, and Harvard Forest.

MANAGEMENT

Project. Methods of cutting in pure and mixed spruce and balsam fir stands (Mc-1).

Scope. To determine (a) the best methods of cutting to use to secure satisfactory natural reproduction in the shortest possible time, and (b) the rate of growth of seedlings and larger trees left after cutting.

Status. Work started in October, 1923, in the spruce flat type in Maine and was continued thru 1924 and 1925. Approximately 400 temporary plots have been established in the spruce and hardwood and spruce flat types in Maine, New Hampshire, Vermont, and New York. On these studies have been made of reproduction before and after cutting and of the growth of seedlings and larger trees left after cutting. Four permanent half-acre sample plots were established in the White Mountain National Forest during the summer of 1924. On Plot 1 softwoods and hardwoods were cut to a low diameter limit. On Plot 2 mature and overmature softwoods were removed and hardwoods cut to favor the development of the residual, thrifty spruce and balsam fir. On Plot 3 the softwoods were cut clear, leaving the hardwoods intact. Plot 4 was left untreated as a check plot.

Plans. Particular emphasis will be placed during the coming year on making full use of the data already secured. This will involve a large amount of office work, and field activities will be confined chiefly to filling in gaps in existing information. Preliminary reports will be prepared during 1926 on the reproduction and growth of spruce and balsam fir on cut-over lands.

Assignment. M. Westveld, Northeastern Forest Experiment Station.

MENSURATION

Project. Development of universal taper and volume tables (ME-1).

Scope. To determine the conformity of various species to a form equation which can be used for the construction of standard taper curves, and the application of such curves in mensuration work.

Status. The manuscript on this project completed in the spring of 1925 has been revised, following the suggestions of the board of review, and submitted for publication. The data for study of application of the form class system to red and white spruce and balsam fir collected in 1925 have been worked up into shape for coding and punching, and will be combined with the 1924 material for detailed study. Preliminary volume tables for these species have been compiled for use in the spruce yield study (ME-2).

Plans. Before the data for 1925 are compiled in combination with the material from the previous season, some time will be spent studying separately the 1924 data which has been through the tabulating machine. In this way weaknesses or deficiencies in the coding and manipulation of the data may be discovered and corrected before final study of the combined data is undertaken. Additional field work will be required to expand the data for white spruce and balsam, and to secure additional form point measurements.

Assignment. C. E. Behre, Northeastern Forest Experiment Station.

MENSURATION

Project. Growth and yield of spruce and balsam fir (ME-2).

Scope. To determine the growth and yield of spruce and balsam fir in different types and in even-aged and uneven-aged stands.

Status. Work was started in September, 1923, and continued thru 1924 and 1925 in Maine, New Hampshire, Vermont, and New York. Altogether, material from about 400 plots is at hand, of which 200 form the basis of a yield table for fully stocked, even-aged, second growth red spruce. A detailed strip survey of over 1,000 acres was made for the study of application of normal tables.

Plans. A bulletin covering all of the material so far obtained will be submitted for publication in the late spring of 1926. In addition to normal yield tables for red spruce and balsam fir, this will contain suggestions on the application of such tables.

Assignment. W. H. Meyer, Northeastern Forest Experiment Station.

PROTECTION

Project. Weather and fuel relationships (Pf, B-5).

Scope. To work out methods for predicting periods of unusual fire hazard on basis of probable weather conditions and inflammability of fuels.

Status. Field work was started in 1925 at Cranberry Lake, N. Y., at two adjacent stations in the spruce-northern hardwoods type. One of these had been clear in 1921 and is now covered with blueberries and other low shrubs; while the other was culled for softwoods at the same time and is now covered with a fairly dense stand of mature northern hardwoods. Readings were taken five times daily from the latter part of July until early October of all important climatic factors and of the duff moisture content. All of the data have been placed on punch cards and a brief preliminary report on the results prepared. The season was so wet that only a few requests for special forecasts were received by the Weather Bureau officials from State Foresters.

Plans. Work at Cranberry Lake, N. Y., will be continued in cooperation with the New York State College of Forestry. A station will be established at Petersham, Mass., in cooperation with the Harvard Forest, and another at Boreas Pond, N. Y., in cooperation with the Empire State Forest Products Association, if sufficient cooperative funds for the purpose are available. In addition to working out the relation between weather conditions and the moisture content of different fuels, special attention will be paid to determining the actual inflammability of the latter. Work on this phase of the project will be tied in with the problem of determining the inflammability of slash in different stages of decay. The Weather Bureau will continue to issue special forecasts to State Foresters on request.

Assignment. S. T. Dana and P. W. Stickel, Northeastern Forest Experiment Station, in cooperation with Weather Bureau, State Foresters, New York State College of Forestry, Empire State Forest Products Association, and Harvard Forest.

PROTECTION

Project. Analysis of forest fire statistics (Pf, D-2).

Scope. To secure from an intensive analysis of available records as complete and accurate information as possible in regard to forest fire hazard, risk, and damage in different parts of the Northeast. Special attention will be paid to the relation between number and size of fires, damage, and cost, and such factors as cause, location, date, elapsed time, weather conditions, forest type, method of cutting and slash disposal, etc.

Status. Records of forest fires in Massachusetts from 1921 to 1924 have been transferred to punch cards are are now being tabulated. Work is progressing on coding and punching all available fire records for New Hampshire, Vermont, Connecticut, and Maine, with the assistance of cooperative contributions totaling $1,350. A conference of northeastern State Foresters and representatives of the Forest Service was held at Boston in January, 1926, which resulted in an agreement on the essential items which should be included in all forest fire reports.

Plans. The data for the various states will be analyzed and put in shape for publication as rapidly as time and funds permit. After the back records have once been compiled, an effort will be made to keep current records for the entire region up to date by transferring them to punch cards as soon as they are available.

Assignment. S. T. Dana and P. W. Stickel, Northeastern Forest Experiment Station, in cooperation with State Foresters.

PROTECTION

Project. Control of the white pine weevil (Pi-4).

Scope. To determine practical and effective measures for the control of the white pine weevil and for minimizing the injury caused by it.

Status. Work began on this project in May, 1925. Observations on the life history and habits of parasites affecting the weevil took up the main portion of the field season. Some 2,500 infested leaders were examined, removed, and placed in cages, and about 2,000 of these kept for further study. The possibility of controlling the injury itself by some form of forest management was also stressed. Over 100 permanent and semi-permanent sample plots have been laid out in various localities in New England. Some work on flight and hibernation habits was done in May, but was curtailed to a great extent by the late date at which work began. Both these phases were studied at length in September, October, and November, and valuable information resulted.

Plans. The same general procedure will be followed as last summer. The study of parasites will be stressed again during the coming season, with special attention to the breeding of the most important and numerous species in the different localities from which specimens were obtained last year.

Assignment. H. J. MacAloney, Northeastern Forest Experiment Station, in cooperation with the Bureau of Entomology, Harvard Forest, State Foresters and Entomologists, and the Entomological Branch, Dominion of Canada Department of Agriculture.

FOREST TYPES

Project. Relation of light and soil moisture to tree growth (T-1).

Scope. To determine the role played by light and soil moisture in the establishment and subsequent development of different species under various conditions.

Status. During 1925 the electrical equipment for measuring light intensities was further perfected, and plans developed for the improvement of Dr. Livingston's "soil point" method of determining available soil moisture. Continuous records were secured of the light intensities at three adjacent stations in the white pine type, - one in a clear cut area, the second in an area where part of the stand has been removed by a shelterwood cutting, and the third in an uncut stand. These are now being worked up for publication, together with some more general material on the relation of light to tree growth.

Plans. During the coming year an effort will be made to perfect the equipment and technique for the measurement of light and soil moisture, and to determine the critical amounts of each necessary for the survival and normal growth of seedlings. The field indications will then be followed up by laboratory experiments under controlled conditions. Field work will be centered at Petersham and office work at Amherst, although it is hoped that several weeks may be spent on the permanent sample plots on the White Mountain National Forest. Work on this project will be tied in with that on the fire weather (Pf, C-7) and slash disposal (Mb-1) projects.

Assignment. P. R. Gast, Northeastern Forest Experiment Station, in cooperation with Harvard University.

Current Projects

Minor Projects

FORESTATION

Project. Source of seed - Scotch pine (Fs-d-1).

Scope. To determine the relative desirability of stock raised from Austrian and Baltic Scotch pine seed for planting in the Northeast; the relative development of Scotch pine, red pine, and white pine on the same site; and the feasibility of underplanting Norway spruce for Christmas tree stock in mixture with pine.

Status. A series of 4 plots, each 1/2 acre in size, was planted in the spring of 1924 as follows: Plot 1, 2-year-old Baltic Scotch pines; Plot 2, 2-year-old Austrian Scotch pine; Plot 3, 2-1 red pine; Plot 4, 2-1 white pine. Trees were planted 6.6' x 6.6'. The west one-half of each plot was underplanted to Norway spruce, one spruce being planted in the center of each 6.6' x 6.6' square. Fail places were filled and complete counts made in the spring of 1925.

Plans. Any additional fail places will be planted in the spring of 1926 in order to keep the plantation fully stocked. Records will be continued indefinitely. Additional nursery sowings will be made as Scotch pine seed of known origin is available.

Assignment. M. Westveld, Northeastern Forest Experiment Station, in cooperation with Massachusetts Conservation Commission and Massachusetts Agricultural College.

MANAGEMENT

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Project.	Practice of forestry by private owners (M-1).
Scope.	To secure information as to the extent to which forestry is being practiced by private owners, the general character of the work being done, and the results secured; and to encourage the practice of private forestry by personal contact, addresses, correspondence, general publicity, publications, and demonstrations.
Status.	A few new examples were secured and new contacts established in 1925.
Plans.	A continuing, all-Service project, on which additional data will be secured and additional assistance to private owners rendered as rapidly as work on other projects permits and, so far as possible, in connection with them.
Assignment.	Staff, Northeastern Forest Experiment Station, in cooperation with State Foresters, Dark Entry Forest, Connecticut, and other organizations and individuals.

MANAGEMENT

Project. Management of sprout hardwood stands (M-2).

Scope. To determine the best methods for the cutting, reproduction, and subsequent handling of sprout hardwood stands in southern New England.

Status. Five permanent sample plots were established in 1924 in sprout land on the Simsbury State Forest, Connecticut. Three of these were on land recently burned and two on adjacent unburned land. One burned plot and one unburned plot were thinned at the time of establishment. Sprouts were counted on the thinned plots in the following year and cut so as to leave one or two of the strongest in each clump. On the other burned plots the sprouts were counted, but no thinning done. Burning was not feasible in 1925 because of the lack of litter.

Plans. The plots will be inspected, condition noted, and sprouts counted in the spring of 1926. One of the three burned plots will be reburned if possible.

Assignment. Staff, Northeastern Forest Experiment Station, in cooperation with Connecticut State Forester.

MANAGEMENT

Project. Replacement of chestnut (M-3).

Scope. To determine what is taking place on blight-killed areas and what species should be favored as substitutes for chestnut from the standpoint both of silviculture and utilization.

Status. (a) Two ¼-acre permanent sample plots were laid out in June, 1924, on the Mt. Toby forest on areas where the blight-killed chestnut had been removed and white pine planted. On one plot all hardwood sprouts were weeded in 1925 to favor the pine, while the other will be held as a check plot.

(b) A final report on the field survey of blight-killed areas has been completed by C. F. Korstian and P. W. Stickel and submitted for publication in the Journal of Agricultural Research.

Plans. (a) A third ¼-acre plot will be established, probably in the fall of 1926, where the dead chestnut is still standing, to observe natural replacement under this condition. The other two plots will be remeasured in the spring of 1926.

(b) Completed.

Assignment. (a) P. W. Stickel, Northeastern Forest Experiment Station, in cooperation with Massachusetts Agricultural College.

(b) Completed.

MANAGEMENT

Project. Management of eastern hemlock (M-4).

Scope. To determine the best methods for the cutting, reproduction, and subsequent handling of hemlock in both pure and mixed stands.

Status. In the spring of 1924, a series of three ¼-acre plots was established on an area on Mount Toby cut over the previous winter. On ¼-acre, 2-1 red pine transplants were set out with as nearly a 6x6 spacing as the hemlock understory would permit. On another ¼-acre, 2-1 white pine were set out in the same way. The third plot was held as a check without planting. Brush was scattered on one-half of each plot and removed on the other half. Planted and natural pine seedlings, residual hemlock, and stumps of trees removed were mapped by plane table and alidade. The approximate area of crown spread of the existing hemlock was also sketched on the maps. Notes on the size and vigor of each tree were also taken. Lists of all the plants found on the area, grouped according to relative abundance, were made in 1924 and 1925, and an herbarium has been started.

Plans. A similar series of plots will be established in 1926, but the work will be less intensive. The detailed map will be omitted and the trees and seedlings will be tallied separately by 1/100 acre subdivisions. This will afford a basis for observing the effect of different seasons on the survival and growth of the hemlock and interplanted pine. A check will be made on the survival of trees planted in 1924 and the subsequent development of the hemlock. Cutting back of hardwood sprouts will also be desirable in 1926.

Assignment. C. E. Behre, Northeastern Forest Experiment Station, in cooperation with Massachusetts Agricultural College.

MANAGEMENT

Project. Permanent sample plots (M-5).

Scope. To maintain the permanent sample plots which were established previous to the organization of the Northeastern Forest Experiment Station.

Status. In the spring of 1925, 74 plots and 45 reproduction plots were remeasured. For various reasons 28 plots and 19 reproduction plots were not remeasured at this time, and 18 plots and 60 reproduction plots were discontinued because of their destruction by cutting. In addition to the plots which the Station maintains, complete records are furnished for the Station's files of the considerable number of permanent plots turned over some years ago to various other agencies.

Plans. Results of the 20 years accumulation of plot measurements will be worked up as opportunity offers and as needed in connection with other projects.

Assignment. Staff, Northeastern Forest Experiment Station.

1926

MANAGEMENT

Project. Pruning of white pine (Mp-1).

Scope. To determine the effect of pruning on white pine at various ages and in stands of various densities.

Status. Approval of this as a new project in 1925 was received too late to make possible its initiation that year.

Plans. Three quarter-acre sample plots will be established in young plantations at Mt. Toby in the fall of 1926. One plot will be pruned the same spring, a second several years later, and the third left intact as a check plot. Additional plots may be established later. Tests will be made to determine whether pruning in transplant beds has any effect on height growth.

Assignment. P. W. Stickel, Northeastern Forest Experiment Station, in cooperation with Massachusetts Agricultural College.

MENSURATION

Project. Regional yields (ME-1, WO).*

Scope. To bring together systematically all available data on the present and potential growth and yield of different species and types in the Northeast.

Status. This is a part of a Service-wide project which originated with the compilation of all available growth and yield data for use in preparing the report on "Timber: Mine or Crop?" Material pertaining to it is being secured as an integral part of several projects now under way.

Plans. Additional data will be secured currently as opportunity offers in connection with other work of the Station. A special effort will be made to obtain figures as to the actual cuts from second growth stands.

Assignment. Staff, Northeastern Forest Experiment Station.

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* This project was designated in the 1925 program as ME-3. The number has been changed to ME-1, WO to correspond with that used by the Washington office.

MENSURATION

Project.	Converting factors (ME-2, WO).
Scope.	To bring together systematically information upon converting factors used for converting timber measured in one unit into another unit.
Status.	This is an all-Service project upon which comparatively little information has so far been obtained.
Plans.	Additional data will be obtained currently as opportunity offers in connection with the other work of the Station.
Assignment.	Staff, Northeastern Forest Experiment Station.

MENSURATION

Project. Manual on forest measurements (ME-3, WO).*

Scope. To prepare a manual on forest measurements with special reference to securing uniformity so far as practicable through the adoption of standard methods.

Status. A special committee was organized in 1924 to handle the work, including three representatives each from the Forest Service, the Society of American Foresters, and the Association of State Foresters. Standardization of volume table procedure has been considered, and agreement reached on most points. An outline of yield table procedure has also been circulated and modifications voted upon.

Plans. In hands of the chairman of committee, E. N. Munns, at Washington.

Assignment. C. E. Behre, Northeastern Forest Experiment Station, in cooperation with other members of the special committee and other forest experiment stations.

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* This project was designated in the 1925 program as ME-4. The number has been changed to ME-3, WO to correspond with that used by the Washington office.

PROTECTION

Project. Chestnut blight (Pd-1).

Scope. To study all phases of the chestnut blight, including the feasibility of perpetuating the chestnut by developing a blight-resistant variety or by other measures.

Status. During 1925 general inquiries were made among the foresters and botanists of the region with a view to obtaining information as to the location of any apparently blight-resistant trees. This resulted in several interesting leads and in the establishment of a number of useful contacts.

Plans. The investigations now under way will be continued, with special reference to the location and development of blight-resistant varieties or individuals.

Assignment. Perley Spaulding, Northeastern Forest Experiment Station, in cooperation with Bureau of Plant Industry, Office of Dendrology, and Brooklyn Botanic Garden.

PROTECTION

Project.	Research on white pine blister rust (Pd-2).
Scope.	Comprehensive study of the life history, epidemiology, and other scientific aspects of white pine blister rust.
Status.	Work has been under way since 1909, and a number of experimental plots have been established in different parts of the region. The present phase of the work is largely on the viability of spores and climatic effects. Additional information regarding the blister rust in Europe has been obtained and a manuscript on European conditions prepared for publication.
Plans.	To be continued along present lines.
Assignment.	Perley Spaulding, Northeastern Forest Experiment Station, in cooperation with Bureau of Plant Industry, New York State College of Forestry, and New York Conservation Commission.

PROTECTION

Project.	Pitch pine blister rust, Cronartium comptoniae (Pd-3).
Scope.	To determine the behavior of this native disease in comparison with the very closely related, but introduced, white pine blister rust.
Status.	Work was started in 1909, and plots are now under observation at many points in New England and New York.
Plans.	To be continued along present lines.
Assignment.	Perley Spaulding, Northeastern Forest Experiment Station, in cooperation with Bureau of Plant Industry.

Projects Dropped

PROTECTION

Project. Control of Gipsy Moth by Forest Management (Pi-1).

Project. Control of Spruce Budworm (Pi-2).

Project. Control of Miscellaneous Forest Insects (Pi-3).

(These projects are being dropped from the Experiment Station's program because they are being handled primarily by other agencies.)

Projects Completed

PROTECTION

Project.	Status of European pine shoot moth (Pi-5).
Scope.	To determine the present status of the European pine shoot moth, with special reference to the possibility of its eradication.
Status.	The proposed survey was made in the spring of 1925. This indicated that the moth is now widely spread throughout the region but does not appear to be doing any serious damage to forest trees. Extermination would be difficult, if not impossible; and in view of the slight damage now evident under forest conditions no particular control measures seem necessary.
Plans.	This will not be continued as a separate project, but close watch of further developments will be maintained by the Bureau of Entomology as part of its current work.
Assignment.	Carl Heinrich, Bureau of Entomology, in cooperation with Northeastern Forest Experiment Station, and State Foresters and Entomologists.

New Projects

PROTECTION

Project. Control of birch borers (Pi-6).

Scope. To determine practical measures for the control of birch borers by forest management.

Status. New project. Considerable damage is being done by borers in yellow birch and paper birch in the northern hardwood region, especially on cut-over areas in the White Mountains, but little information is available as to the extent of the injury or the possibility of control.

Plans. Little more will be attempted during the coming field season than to get definite information as to the extent and severity of injury, and as to the best locations for further study.

Assignment. H. J. MacAloney, Northeastern Forest Experiment Station, in cooperation with Bureau of Entomology, Harvard Forest, and White Mountain National Forest.